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FLOOD INSURANCE STUDY

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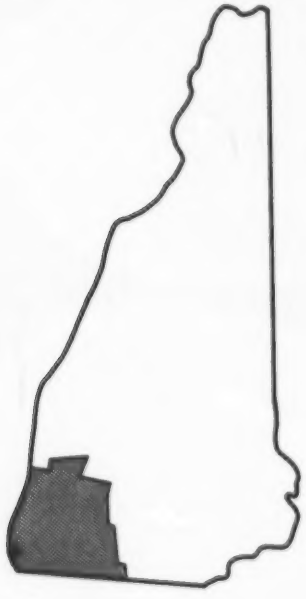
TOWN OF HINSDALE, NEW HAMPSHIRE
CHESHIRE COUNTY



OCTOBER 15, 1980

federal emergency management agency
federal insurance administration

COMMUNITY NUMBER - 330022

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index

Flood Insurance Rate Map

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Hinsdale, Cheshire County, New Hampshire, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Hinsdale to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally-supported studies are based. These criteria take precedence over the minimum federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 24 CFR, 1910.1(d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by Environmental Engineers, Inc., for the Federal Insurance Administration, under Contract No. H-4590. This work, which was completed in December 1978, covered all significant flooding sources in the Town of Hinsdale.

1.3 Coordination

Community base map selection and the identification of streams requiring detailed study were accomplished at a meeting that was held in July 1977, and was attended by representatives of the Town of Hinsdale, the FIA, and Environmental Engineers, Inc. (the study contractor).

Hydrologic analyses and flood profiles for all flooding sources were coordinated with previous work performed by the U. S. Army Corps of Engineers (COE), Waltham, Massachusetts. The study contractor met with the COE in March 1978 to coordinate the hydrologic data for the Connecticut River. The frequency-discharge estimates for all streams studied by detailed methods were submitted for review to FIA's New England Regional Office in April 1978.

On January 30, 1979, an interim Consultation and Coordination Officer's (CCO) meeting was held in the Town of Hinsdale. In attendance were town officials, citizens, and personnel of the FIA and the study contractor.

On September 12, 1979, the results of the study were reviewed at a final CCO meeting attended by representatives of the study contractor and the FIA, and officials and citizens of the Town of Hinsdale.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Hinsdale, Cheshire County, New Hampshire. The area of study is shown on the Vicinity Map (Figure 1).

The streams in the Town of Hinsdale selected for detailed study at the initial CCO meeting were the Connecticut River, the Ashuelot River, and Sprague Brook. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction for the next five years, through December 1983.

Approximate methods of analysis were used to study the following streams: Lamson Brook, Ash Brook, Lily Pond Brook, Liscom Brook, Bell Brook, Kilburn Brook, Hog Tongue Brook, the upper portion of Sprague Brook, an unnamed tributary to the Connecticut River, herein designated Tributary A, and various unnamed tributaries to these streams within the community. Approximate methods of analysis were used to study those areas having low development potential and minimal flood hazards as identified at the initiation of the study. The scope and methods of study were proposed to and agreed upon by the FIA.

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF HINSDALE, NH
(CHESHIRE CO.)

Swanzey
East Swanzey
North Richmond
Richmond
Winchester
Hinsdale
Brattleboro
Putney
Westminster
Bellows Falls
Walpoole
Keene
Chesterfield
Gilsum
Marlborough
Troy
Fitzwilliam
Rindge
Jaffrey
Peterborough
Hancock
Antrim
Bennington
Francestown
Greenfield
Mount Monadnock
Mount Pisgah
Mount Kearsarge
Mount Sunapee
Mount Ascutney
Mount Wantastiquet
Mount Caesar
Mount Prospect
Mount Temple
Mount Watatic
Mount Grace
Mount Lincoln
Mount Orne
Mount Toby
Mount Tom
Mount Holyoke
Mount Norwottuck
Mount Sugarloaf
Mount Warner
Mount Kearsarge
Mount Monadnock
Mount Pisgah
Mount Sunapee
Mount Ascutney
Mount Wantastiquet
Mount Caesar
Mount Prospect
Mount Temple
Mount Watatic
Mount Grace
Mount Lincoln
Mount Orne
Mount Toby
Mount Tom
Mount Holyoke
Mount Norwottuck
Mount Sugarloaf
Mount Warner
Connecticut River
Ashuelot River
Millers River
Contoocook River
Nashua River
Merrimack River
Otter Brook
Ashuelot Pond
Spectacle Pond
Meetinghouse Pond
Stone Pond
Granite Pond
Dublin Pond
Silver Lake
Sunapee Lake
Lake Monomonac
Lake Massapesett
Lake Whalom
Lake Shaw
Lake Dennison
Lake Wyola
Lake Wyola
Lake Dennison
Lake Shaw
Lake Whalom
Lake Massapesett
Lake Monomonac
Sunapee Lake
Dublin Pond
Granite Pond
Stone Pond
Meetinghouse Pond
Spectacle Pond
Ashuelot Pond
Millers River
Contoocook River
Nashua River
Merrimack River
Otter Brook
Connecticut River
Ashuelot River
NEW HAMPSHIRE
MASSACHUSETTS
CHESHIRE
WORCESTER
HAMPSHIRE
FRANKLIN
HAMPDEN
NORTHFIELD
ORANGE
ROYALSTON
WINCHENDON
STODDARD
HANCOCK
DUBLIN
PETERBOROUGH
JAFFREY
RINDGE
FITZWILLIAM
TROY
MARLBOROUGH
GILSUM
CHESTERFIELD
WESTMINSTER
PUTNEY
BRATTLEBORO
HINSDALE
WINCHESTER
RICHMOND
SWANZEY
KEENE
WALPOLE
BELLOWS FALLS
WESTERN MOUNTAINS
GREEN MOUNTAINS
Pierce Hill
Goose Pond
Chesham Pond
Bobbin Mill Reservoir
Oak Hill
Stone Pond
Meetinghouse Pond
Forbush Hill
Mount Pierce
Mount Kearsarge
Bullard Hill
Bullard Hill
Mount Kearsarge
Forbush Hill
Meetinghouse Pond
Stone Pond
Oak Hill
Chesham Pond
Bobbin Mill Reservoir
Goose Pond
Pierce Hill
Mount Pierce

Bell Brook, Tributary A, and several unnamed tributaries to streams within the community were found to have negligible flood hazards; therefore, no flood boundaries were mapped for them.

2.2 Community Description

The Town of Hinsdale is located in the southwestern portion of Cheshire County, in southwestern New Hampshire. The town is bordered on the north by the Town of Chesterfield, on the east by the Town of Winchester, and on the west by the Connecticut River, west of which is the State of Vermont. The southern boundary of Winchester is the New Hampshire-Massachusetts state line.

In 1970, the population of Hinsdale was 3,276; this was an increase of nearly 50 percent over the 1960 population of 2,187.

There is a large oxbow in the Connecticut River about midway between the north and south borders of the town, near the mouth of the Ashuelot River. The waters in this area of the town were known as "Squakheug," which means a place for spearing salmon. The Indians in this area were also known as the Squakheugs. During colonial times the Squakheugs were a rich and powerful tribe, whose principal villages were near this oxbow in the river. In 1687, Newellet, a chief of the Squakheugs, granted to the proprietors of Northfield, Massachusetts, a tract of land which included what is now the Town of Hinsdale.

Until 1740 the Town of Northfield, Massachusetts, claimed all the territory of Hinsdale. However, after the border dispute of 1741, between Massachusetts and New Hampshire, Hinsdale became a part of the Colony of New Hampshire. The town received its charter in 1753. The most prominent of the town's founders was Colonel Ebenezer Hinsdale, for whom the town was named.

The Connecticut and Ashuelot Rivers have had a large impact upon the town. The Ashuelot empties into the Connecticut in Hinsdale, a feature which made the town a transportation center during the 1700s, and attracted a number of boatmen and lumbermen who logged the surrounding area. During the 1800s, the water power of these rivers was harnessed to run numerous textile mills. This industry continued into the twentieth century when, with the general decline of northern textile industries, the economic base of the town became more diversified.

Hinsdale and the surrounding area occupy a plateau that slopes to the south and west, surmounted by several mountains. This plateau is cut in many areas by streams flowing into the Connecticut River. For the most part, the area is covered by glacial till, about two-thirds of which is derived principally from granitic rock debris and the rest from schist rocks. Soils developed on this till are naturally stony, and most of the area is unsuitable for large-scale agricultural activities, except in the broad flood plains of the area's rivers, particularly the Connecticut River.

Generally, the climate consists of warm summers and cold winters, unmodified by the influence of the Atlantic Ocean as in southern and eastern New England. The summers are generally moderate, with few very hot days. The average frost-free period extends from May 25 to September 12, a period of 117 days, although frost has been recorded as late as June 21 and as early as August 25.

The rainfall averages approximately 38 inches per year, and is fairly evenly divided over the year.

There is no significant flood plain development in the Town of Hinsdale.

2.3 Principal Flood Problems

Most flooding problems in the Town of Hinsdale have been caused by the Connecticut River. Damaging floods along the Connecticut River have been recorded since the 1700s. Major nineteenth-century flood events occurred in May 1818, March 1826, September 1828, March 1837, March 1839, January 1841, April 1862, April 1869, October 1869, and April 1895. The major floods of this century were in March 1913, November 1927, March 1936, and September 1938. The most recent flood of significance occurred in March 1968.

Much of New England and upstate New York was severely affected by the November 1927 flood event; many homes and industries located along the banks of the Connecticut River were severely damaged. Very similar was the destructive effect of the March 1936 flood, which was caused by a combination of two weeks of rain and snowmelt.

The March 1968 flood resulted in the third highest stage elevation recorded on the Connecticut River at North Walpole, New Hampshire. This flow, 93,100 cubic feet per second (cfs), represents an approximate 15-year recurrence interval. Damage was confined to roadways and properties near the Connecticut River.

There have been 19 major floods in the Ashuelot River basin since 1738. The flood of October 1869 probably caused the greatest damage. Destruction of property by this flood was immense, and the loss in New England alone was estimated to have run as high as 100 million dollars.

The largest recent floods occurred in March 1936 and September 1938. The 1936 flood was the greatest volume flood of record, while the 1938 flood, which resulted from a hurricane, was the greatest flood peak of record in the Connecticut River basin (Reference 1).

2.4 Flood Protection Measures

The Connecticut River is regulated by power plant dams and flood-control reservoirs located on the river and its tributaries. These control measures have a combined usable storage capacity of 24.8 billion cubic feet. The Surry Mountain Dam was constructed in 1942 on the Ashuelot River, and has a flood-storage capacity of 32,500 acre-feet. The Otter Brook Dam, completed in 1958, is located on Otter Brook about 5 miles above its confluence with the Ashuelot River. It has a flood-storage capacity of 17,600 acre-feet. These dams provide a valuable measure of flood protection to Hinsdale. The Vernon Dam on the Connecticut River and Dams No. 1 and 2 on the Ashuelot River do not have considerable storage capacity and therefore, do not provide flood protection.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one-percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten) and, for any 90-year period, the risk increases to about

60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

For the portions of the streams studied by detailed methods, the area-ratio technique was applied, based on the assumption that flows along a stream increase or decrease according to the ratio of the drainage area with unknown flows to the drainage area with known flows.

The flow data were obtained from the stream flow records at U. S. Geological Survey (USGS) Gage No. 01161000 on the Ashuelot River, just upstream of the Northfield Road bridge in Hinsdale.

To establish values for the 10-, 50-, 100-, and 500-year floods on the Ashuelot River, the log-Pearson Type III analysis was applied, using the stream flow records from the Ashuelot River since 1958 (Reference 2). The application of this method involves fitting a flow-frequency curve to measured stream flow data.

To establish flows on the ungaged Sprague Brook, the Soil Conservation Service (SCS) method was used (Reference 3).

A summary of drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
CONNECTICUT RIVER					
At Hinsdale-Northfield boundary	6,765	91,300	126,000	144,200	191,700
At Vernon Dam	6,266	86,500	120,000	136,700	181,700

TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEA
ASHUELOT RIVER					
At confluence with Connecticut River	420.0	6,410	8,450	9,410	11,780
At Hinsdale-Winchester boundary	411.2	6,320	8,330	9,270	11,610
SPRAGUE BROOK					
At confluence with Connecticut River	0.91	110	210	270	440

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flooding sources.

Cross-section data for streams in the area were obtained by field measurement. All bridges and culverts were surveyed to obtain elevation data and structural geometry.

Water-surface profiles of floods were developed using the COE HEC-2 step-backwater computer model (Reference 4). The starting elevations for the streams under study were developed by the slope-area method (Reference 4).

Channel roughness factors (Manning's "n") used in the hydraulic analyses were assigned on the basis of field inspection and aerial photos of flood plain areas. For the Connecticut River, the channel "n" values ranged from 0.037 to 0.05 and the overbank values ranged from 0.05 to 0.1; for the Ashuelot River the channel "n" ranged from 0.04 to 0.06 and the overbank "n" ranged from 0.1 to 0.12; on Sprague Brook the channel value was 0.06 and the overbank value was 0.12. The high values are associated with thickly overgrown overbanks along some stream segments studied.

Water-surface elevations on Sprague Brook are influenced by backwater from the Connecticut River for most of the brook's length within Hinsdale.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Locations of selected cross sections used in the

hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 3).

All elevations used in this study are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Sea Level Datum of 1929. Locations of the elevation reference marks used in the study are shown on the maps.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are valid only if hydraulic structures remain unobstructed, and dams and other flood control structures operate properly and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps enlarged to a scale of 1:12,000 with a contour interval of 20 feet (Reference 5). In cases where the 100- and 500-year flood boundaries are either close together or collinear, only the 100-year boundary has been shown.

The 100-year flood boundaries for the approximate study streams were taken from the Flood Hazard Boundary Map for Hinsdale, published in March 1974 and revised in May 1976 (Reference 6).

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 3). Small areas within the flood boundaries may lie above the flood elevations and, therefore, may not be subject to flooding. Owing to limitations of the map scale and lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plains. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 3), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

Portions of the floodway widths computed for the Connecticut River are located outside the Hinsdale corporate limits.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Connecticut River								
A	4,460[1]	915[3]	29,085	5.0	209.8	209.8	210.8	1.0
B	12,560[1]	726[3]	28,165	5.1	211.7	211.7	212.7	1.0
C	16,260[1]	1,092[3]	34,774	4.1	212.9	212.9	213.9	1.0
D	19,660[1]	739[3]	22,973	6.0	213.2	213.2	214.2	1.0
E	24,410[1]	1,838[3]	48,616	2.8	214.4	214.4	215.4	1.0
F	27,210[1]	642[3]	23,718	5.8	214.5	214.5	215.5	1.0
G	39,760[1]	3,058[3]	56,783	2.4	226.8	226.8	227.8	1.0
H	42,760[1]	1,800[3]	38,022	3.6	227.1	227.1	228.0	0.9
I	45,810[1]	1,890[3]	41,665	3.3	227.5	227.5	228.4	0.9
J	55,260[1]	680[3]	21,181	6.5	229.2	229.2	230.1	0.9
K	59,410[1]	535[3]	18,307	7.5	231.2	231.2	232.1	0.9
L	64,570[1]	1,600[3]	32,607	4.2	233.6	233.6	234.4	0.8
M	65,240[1]	1,320[3]	33,559	4.1	233.8	233.8	234.6	0.8
Ashuelot River								
A	620[2]	100	1,160	8.1	213.1	190.5[4]	191.4	0.9
B	4,220[2]	1,000	1,114	8.4	213.1	198.3[4]	198.4	0.1
C	7,610[2]	151	1,086	8.7	218.6	218.6	218.9	0.3
D	7,750[2]	170	925	10.2	231.8	231.8	231.8	0.0

[1]Feet above corporate limits
[2]Feet above confluence with Connecticut River
[3]This width extends beyond corporate limits
[4]Elevations computed without consideration of backwater effects from Connecticut River

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF HINSDALE, NH

(CHESHIRE CO.)

FLOODWAY DATA

CONNECTICUT RIVER AND ASHUELOT RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Ashuelot River (continued)								
E	7,790	178	2,208	4.3	233.7	233.7	233.7	0.0
F	11,530	149	893	10.5	258.7	258.7	258.7	0.0
G	11,550	216	961	9.8	263.6	263.6	263.6	0.0
H	11,660	123	2,765	3.4	265.8	265.8	265.8	0.0
I	13,460	200	707	13.1	293.3	293.3	293.3	0.0
Sprague Brook								
A	470	77	390	0.7	229.6	229.6	230.6	1.0

[1]Feet above confluence with Connecticut River

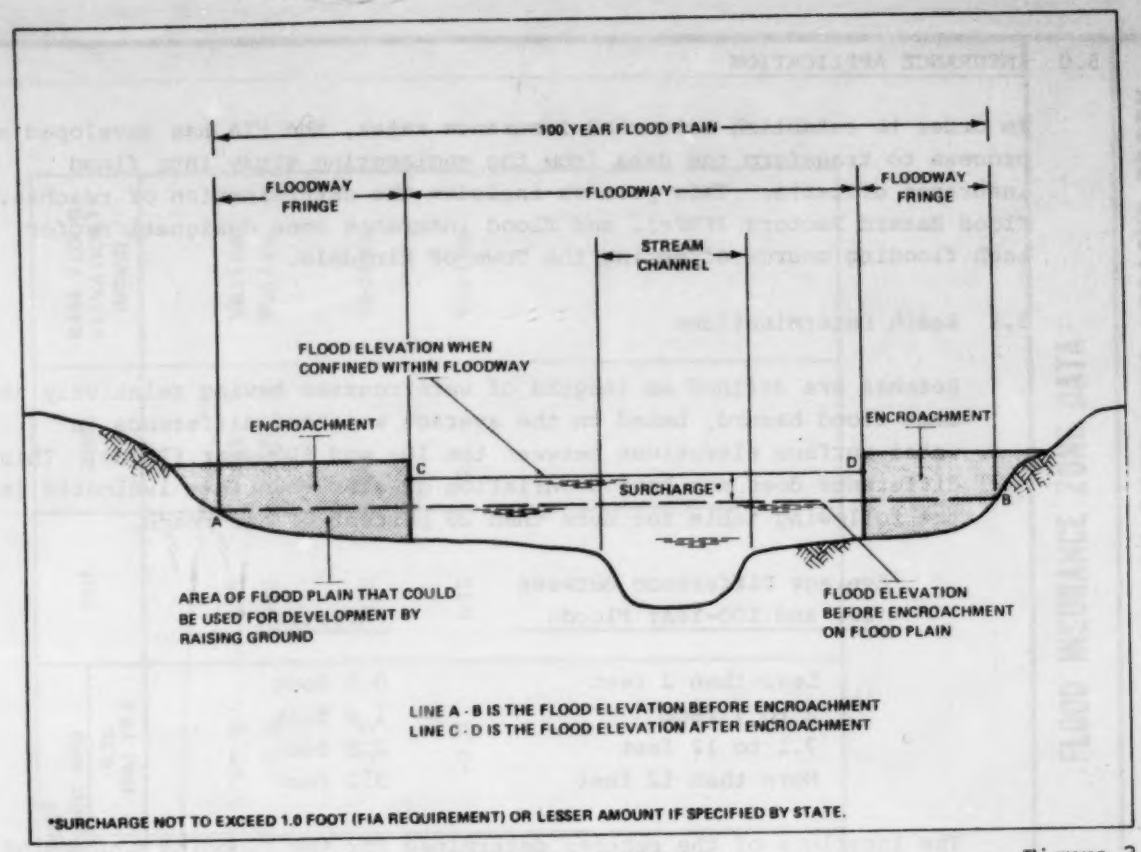
TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF HINSDALE, NH
(CHESHIRE CO.)

FLOODWAY DATA

ASHUELOT RIVER AND SPRAGUE BROOK


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

Floodwaters from the Ashuelot River from about 2,500 feet upstream of Depot Street to the corporate limits were found to have hazardous velocities. Encroachment into areas subject to inundation by floodwaters having hazardous velocities aggravates the risk of flood damage, and heightens potential flood hazards by further increasing velocities. To provide guidance for encroachment into these areas, a proposed floodway is delineated for that part of the 100-year flood plain that conveys flow.

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "With Floodway" elevations presented in Table 2 for certain downstream cross sections of the Ashuelot River are lower than the regulatory flood elevations in that area, which must take into account the 100-year flooding due to backwater from other sources.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each flooding source affecting the Town of Hinsdale.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of Hinsdale are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors

The FHF is the FIA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Connecticut River							
Reach 1	10	-7.6	-2.3	+5.1	075	A15	Varies
Reach 2	05,10	-5.2	-1.8	+5.1	050	A10	Varies
Ashuelot River Reach 1	05,10	-2.8	-0.8	+2.0	030	A6	Varies
Sprague Brook Reach 1	05	-3.6	-0.4	+2.8	035	A7	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted average
[3]Rounded to the nearest foot - see map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration
TOWN OF HINSDALE, NH
(CHESHIRE CO.)

FLOOD INSURANCE ZONE DATA

CONNECTICUT RIVER, ASHUELOT RIVER, AND SPRAGUE BROOK

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the Town of Hinsdale was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zones A6, A7, A10, A15:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also, areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the Town of Hinsdale.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Hinsdale is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

The New England District office of the COE prepared a flood plain study of the Connecticut River, as part of a comprehensive water and land resources report on the Connecticut River Basin, released by the Connecticut River Basin Coordinating Committee in June 1970 (Reference 7). This study contains profiles of the COE standard project flood along the Connecticut River, which was based on recorded high-water marks of the 1927, 1936, and 1938 floods, and rating curves developed at selected index stations. The results of the two studies are in agreement.

A Flood Insurance Study for the adjacent Town of Winchester, New Hampshire, was prepared concurrently with the present study (Reference 8). Data used in both studies were coordinated to ensure agreement of results across municipal boundaries.

This study is authoritative for purposes of the Flood Insurance Program, and the data presented here either supersede or are compatible with previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Insurance and Mitigation Division of the Federal Emergency Management Agency, Regional Director, Region I Office, J. W. McCormack Post Office and Courthouse Building, Room 462, Boston, Massachusetts 02109.

8.0 BIBLIOGRAPHY AND REFERENCES

1. U. S. Army Corps of Engineers, New England Division, Flood Plain Information, Ashuelot River, City of Keene, New Hampshire, Waltham, Massachusetts, December 1972.

2. Water Resources Council, "Guidelines for Determining Flood Flow Frequency," Bulletin 17A, Washington, D. C., June 1977.

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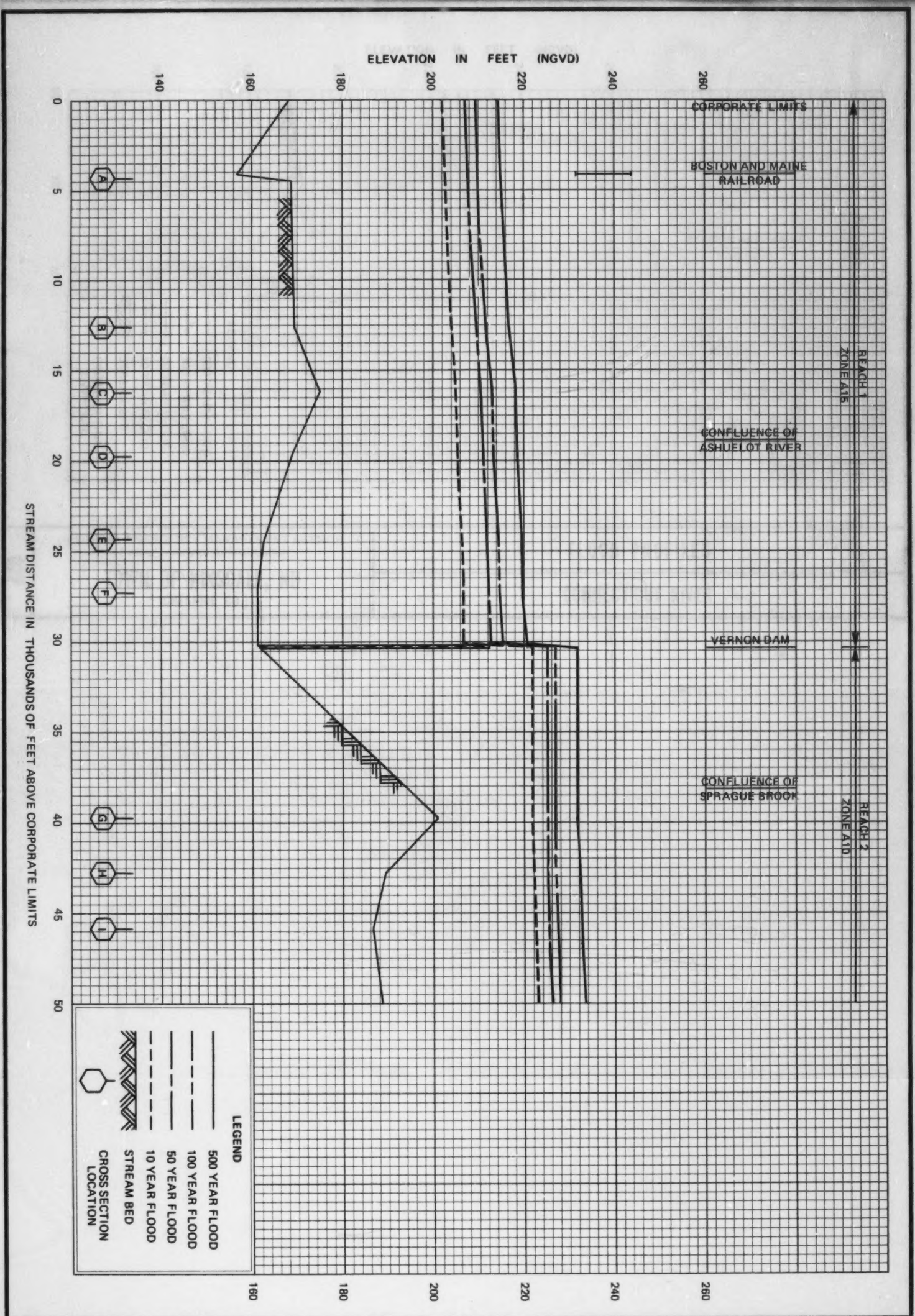
4. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Users Manual, Davis, California, October 1973.

5. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet: Keene, New Hampshire, 1932, Photorevised 1958.

6. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Town of Hinsdale, Cheshire County, New Hampshire, March 8, 1974, Revised May 14, 1976.

7. Connecticut River Basin Coordinating Committee, Comprehensive Water and Related Land Uses Investigation, Connecticut River Basin, Keene, New Hampshire, June 1970.

8. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Town of Winchester, Cheshire County, New Hampshire (Unpublished).



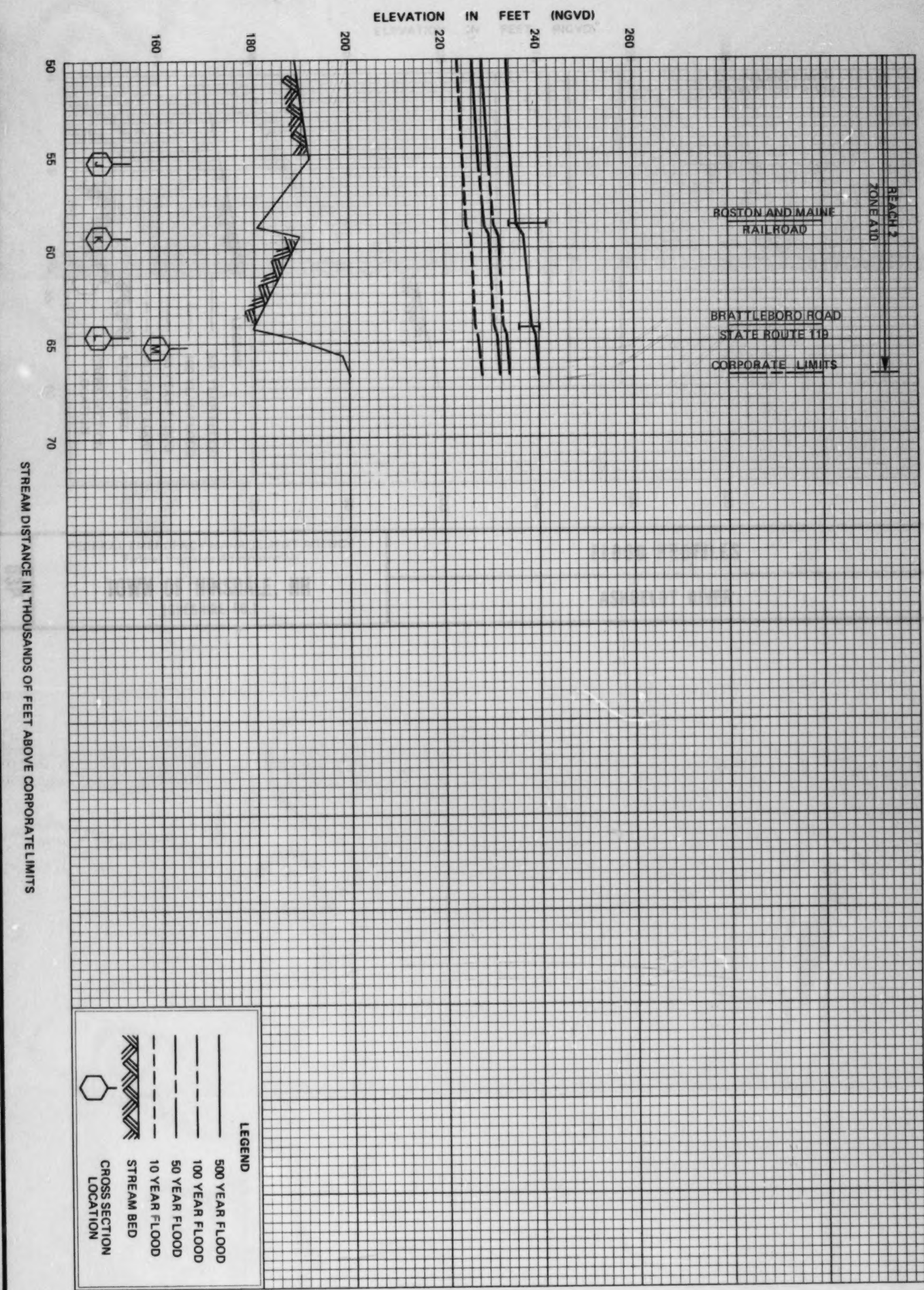
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF HINSDALE, NH
(CHESHIRE CO.)

FLOOD PROFILES

CONNECTICUT RIVER

01P



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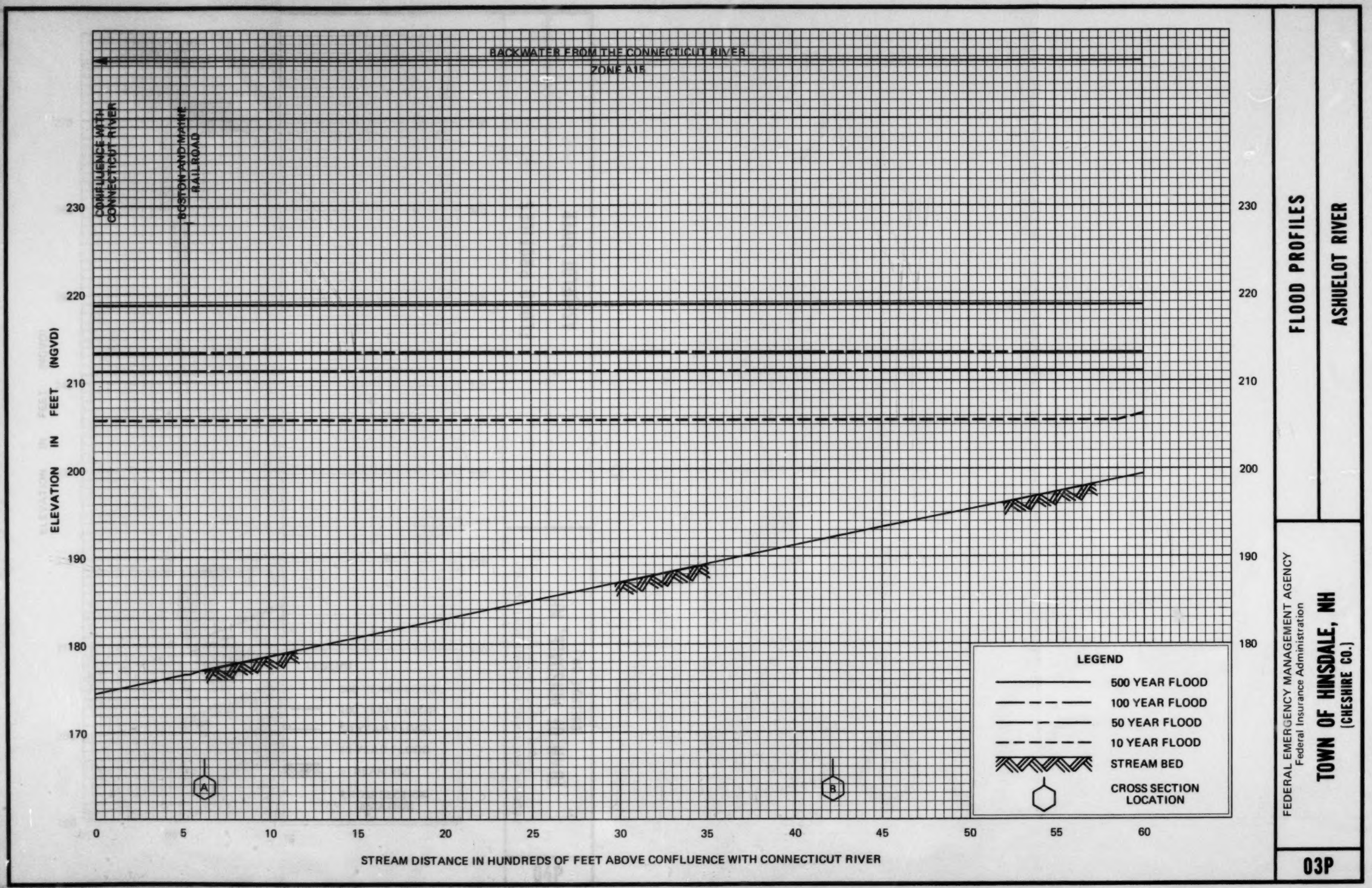
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF HINSDALE, NH
(CHESHIRE CO.)

FLOOD PROFILES

CONNECTICUT RIVER



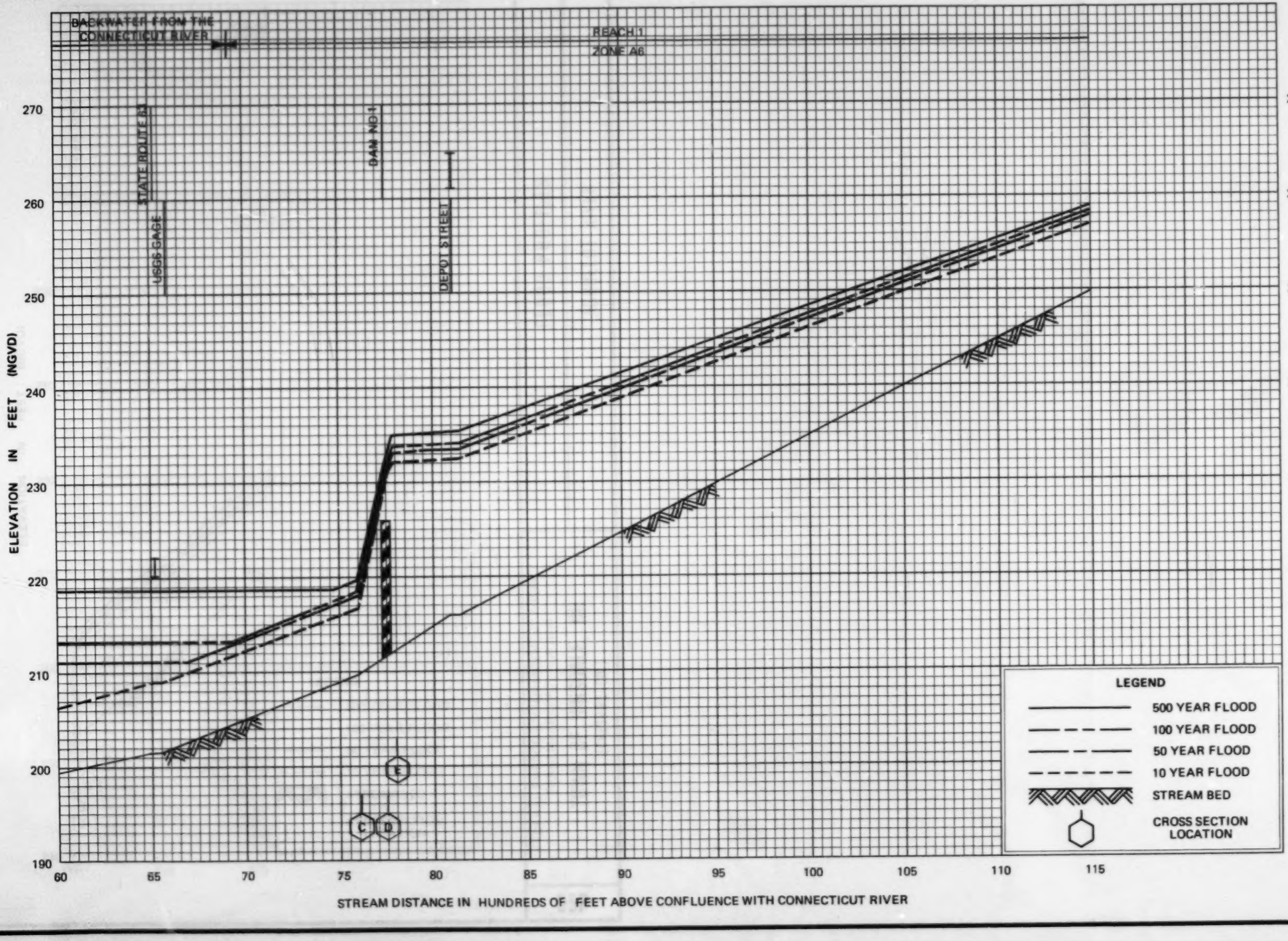
FLOOD PROFILES

ASHUELOT RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF HINSDALE, NH
(CHESHIRE CO.)

03P



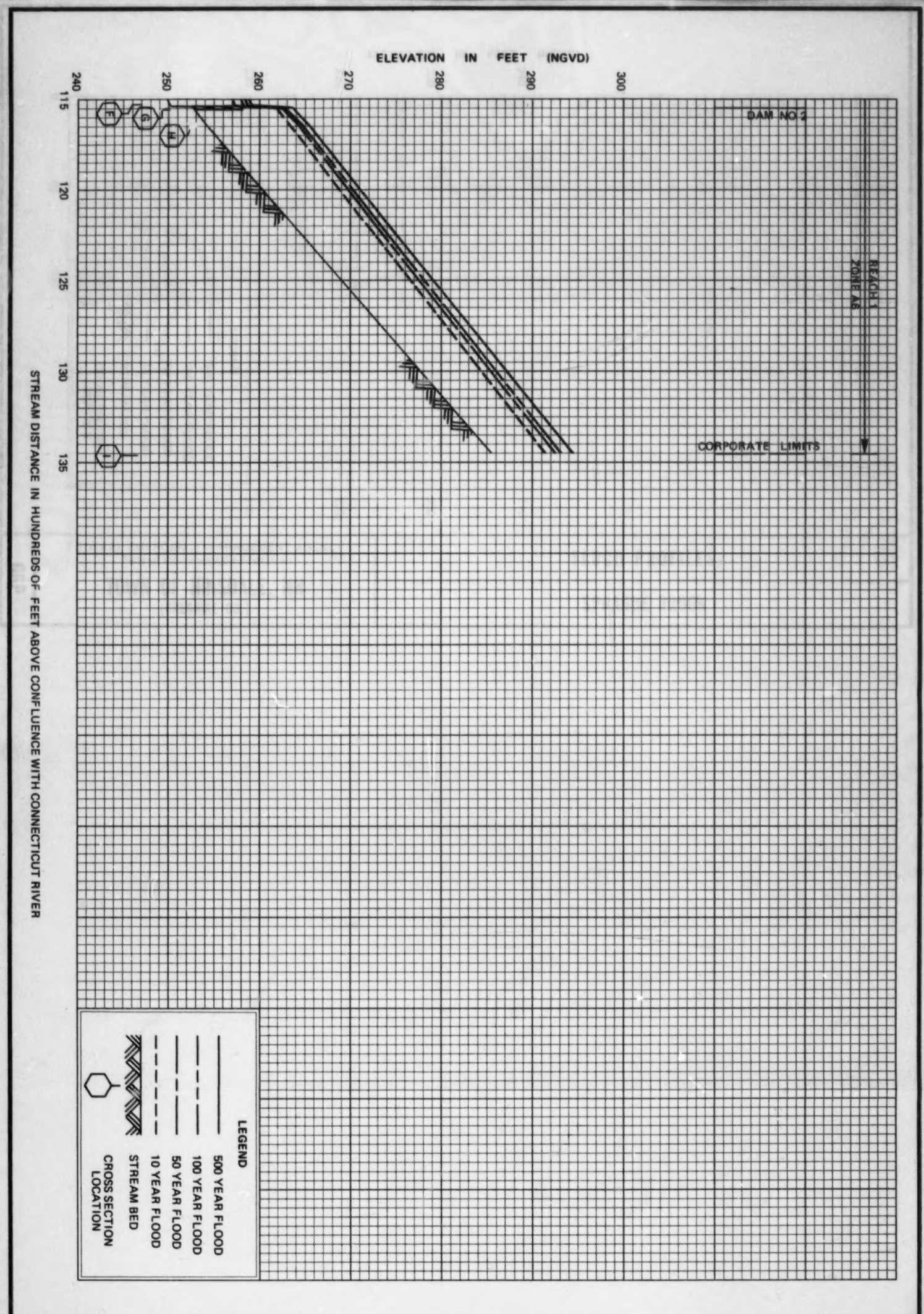
FLOOD PROFILES

ASHUELOT RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF HINSDALE, NH
(CHESHIRE CO.)

04P



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FEDERAL EMERGENCY MANAGEMENT AGENCY
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TOWN OF HINSDALE, NH
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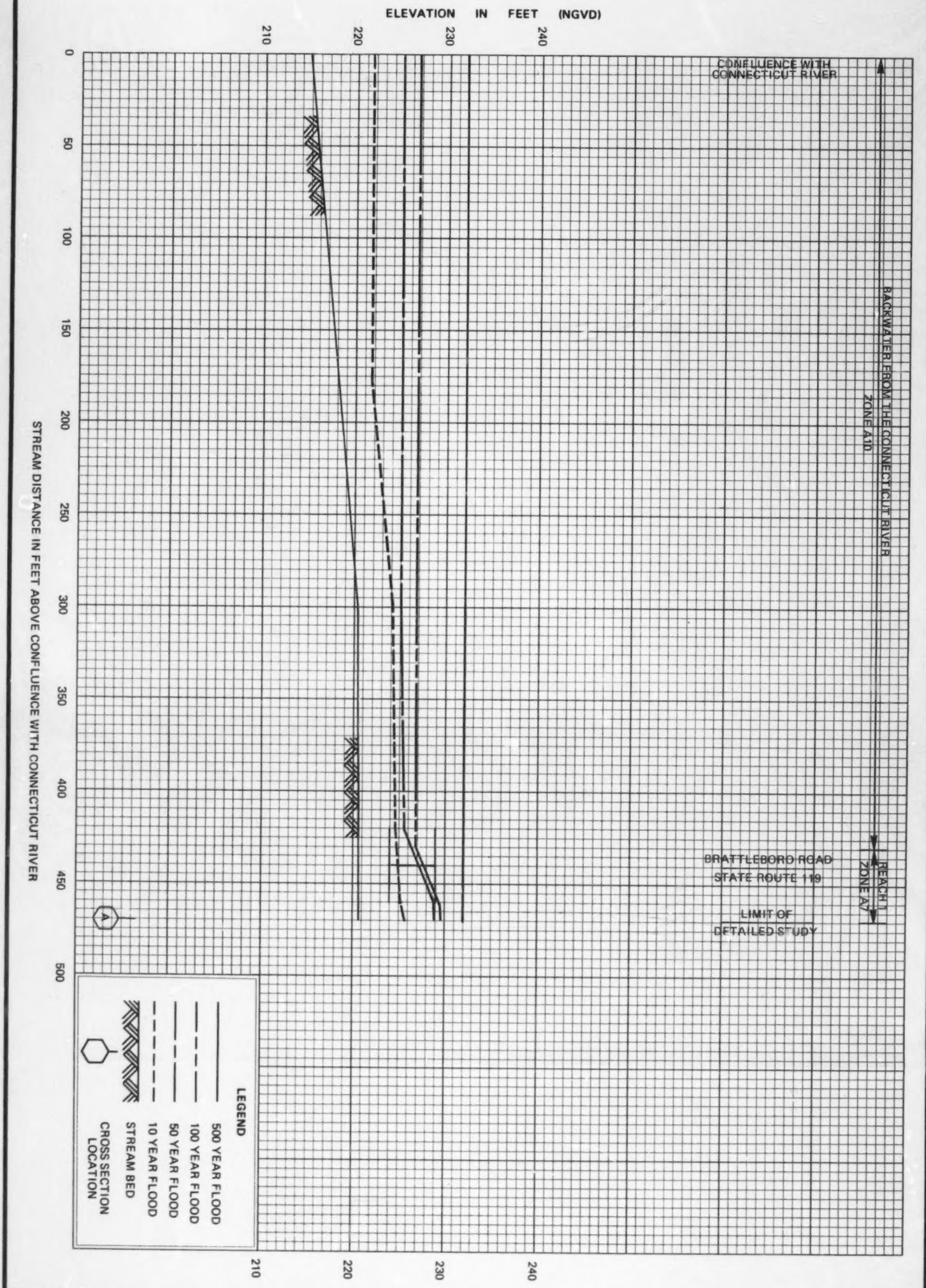
FLOOD PROFILES

ASHUELOT RIVER



06P

FEDERAL EMERGENCY MANAGEMENT AGENCY
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FLOOD PROFILES

SPRAGUE BROOK